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**Naval Oceanographic Office**

Stennis Space Center
MS 39522-5001

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(2)

# MODIFICATION OF THE STERN U-FRAME SYSTEM ON USNS SILAS BENT AND USNS KANE

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**SEAFLOOR INSTRUMENTATION DIVISION**



Prepared under the authority of
**Commander,**
**Naval Oceanography Command**

A modification of the Stern U-Frame systems on the USNS SILAS BENT and USNS KANE was developed to improve handling provisions during deployment and retrieval of large underwater tow bodies. Subject modifications on each ship were completed in 1989 with positive results.

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19 ABSTRACT (Continue on reverse if necessary and identify by block number)

A modification of the Stern U-Frame systems on the USNS SILAS BENT and USNS KANE was developed to improve handling provisions during deployment and retrieval of large underwater tow bodies. Subject modifications on each ship were completed in 1989 with positive results.

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## I. INTRODUCTION

In Fiscal Year 1987, the Acoustics Division of the Oceanographic Department experienced numerous and very costly accidents involving their Towed Acoustic Reverberation Survey System (TARSUS) underwater towbody and the stern of survey platforms such as the USNS SILAS BENT. With the upcoming acquisition of an even larger towbody designated Low Frequency Towed Acoustic Projector System (LFTAPS), an engineering project was undertaken to provide a near-term solution to the problems of handling large-size vehicles from these platforms.

The Mechanical Systems Branch of the Engineering Department developed a mechanical redesign concept for the Stern U-Frame structure that would increase the outboard reach of the structure, thereby decreasing the chances of further costly collisions. This report is submitted to document the engineering project.

## II. PROJECT DESCRIPTION

The technical approach used for this project was to utilize Naval Oceanographic Office (NAVOCEANO) Engineering support combined with Military Sealift Command (MSC) contractors to redesign, fabricate, and install modified U-Frame supports and hydraulic cylinders to enable the lifting structure of the U-Frame to extend farther past the stern edge of the ship's main deck. The additional extension of the structure provides extra clearance margin between the stern edge and the towbody being deployed or retrieved. Another benefit of the modified geometry allows for a lower tow sheave elevation during retrieval operations, shortening the pendulum arm created by the towcable, and ultimately further reducing the potential for damaging collisions between the towbody and the ship's hull.

The NAVOCEANO effort involved providing engineering support to redesign and fabricate new U-Frame supports and hydraulic cylinders. Also, NAVOCEANO engineering would monitor installation of the new assemblies, verify operation, and establish any new testing criteria.

MSC reviewed the proposed redesign and approved system changes. Supplementary approvals from the American Bureau of Shipping (ABS) and the Coast Guard (CG) were sought. MSC officials obtained ABS and CG approvals necessary to document compliance of system design changes to established equipment and safety standards. MSC was then tasked to provide contractor services to perform the necessary installations given NAVOCEANO Engineering guidance.

## III. DESIGN CONSIDERATIONS AND MODIFICATIONS

Figure 1 illustrates the original configuration of the U-Frame system. The inboard and outboard positions are depicted to provide the relative travel of the lifting structure. Of particular interest is the location and elevation of the towing sheave hanging from the cross member of the U-Frame.

Figure 2 gives the swing geometry of a 12-foot-long towbody as it hangs from its towcable. Note that a swing angle of only 15 degrees from the vertical is required to cause a collision between the towbody and the ship's stern once the towbody has broken the water surface. The same angular motion can cause collision between the towbody and the ship's rudder when the towbody is below the water surface.

Similar geometry is presented in figure 3 for the modified configuration. Note the major change in swing distance and angle required even to come close to the ship's hull and rudder. Given the towcable length from sheave to towbody, the only concern comes into play when the towbody is below the water surface and experiences sea state conditions that could generate a swing of greater than 50 degrees.

## IV. SYSTEM RECONFIGURATION

In order to accomplish the modified configuration in figure 3 with minimal changes, the existing lifting structure was kept as a constant while the support structure and hydraulic lifting cylinder designs were changed. Also, it was desirable to retain the towing and inboard positions. The new positions of the U-Frame are presented in figure 4.

The support structure was redesigned to allow the lifting structure to pass through the upright section that supports the U-Frame in its towing position. Also, the new design provides a movable frame seat to accommodate the swing of the lifting structure and provide support for the structure during towing operations. The frame support and frame seat are documented by appendices A and B, respectively.

The design of the hydraulic cylinders that power the lifting structure was changed from simple double-acting to a design incorporating double-action motion and telescoping stages. The final design of the new hydraulic cylinders is provided in appendix C, pages C-1 through C-7. Protective covers for the stages of the cylinders were designed, fabricated, and installed. Page C-9 documents the protective covers.

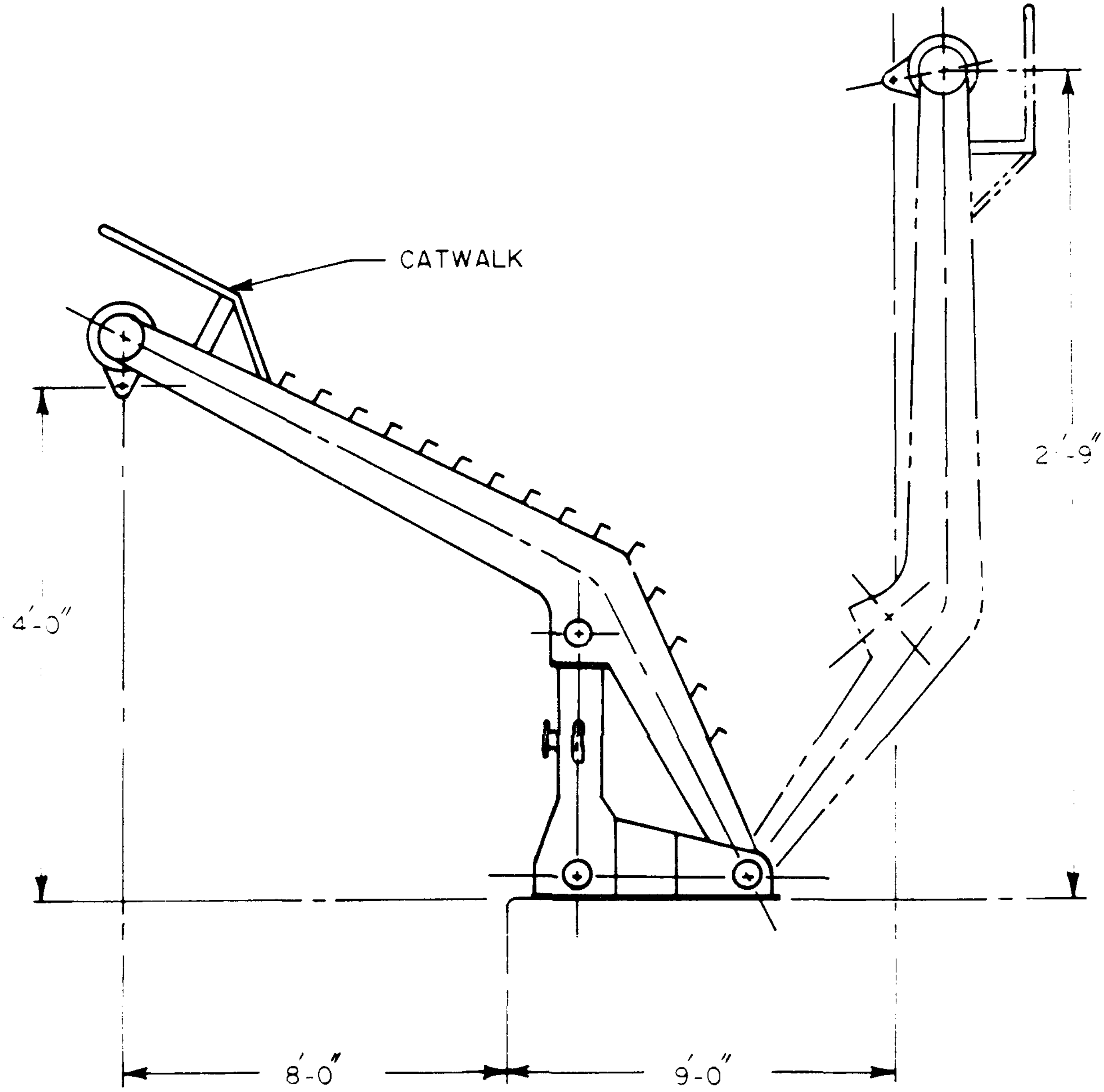


Figure 1. Original U-Frame configuration.

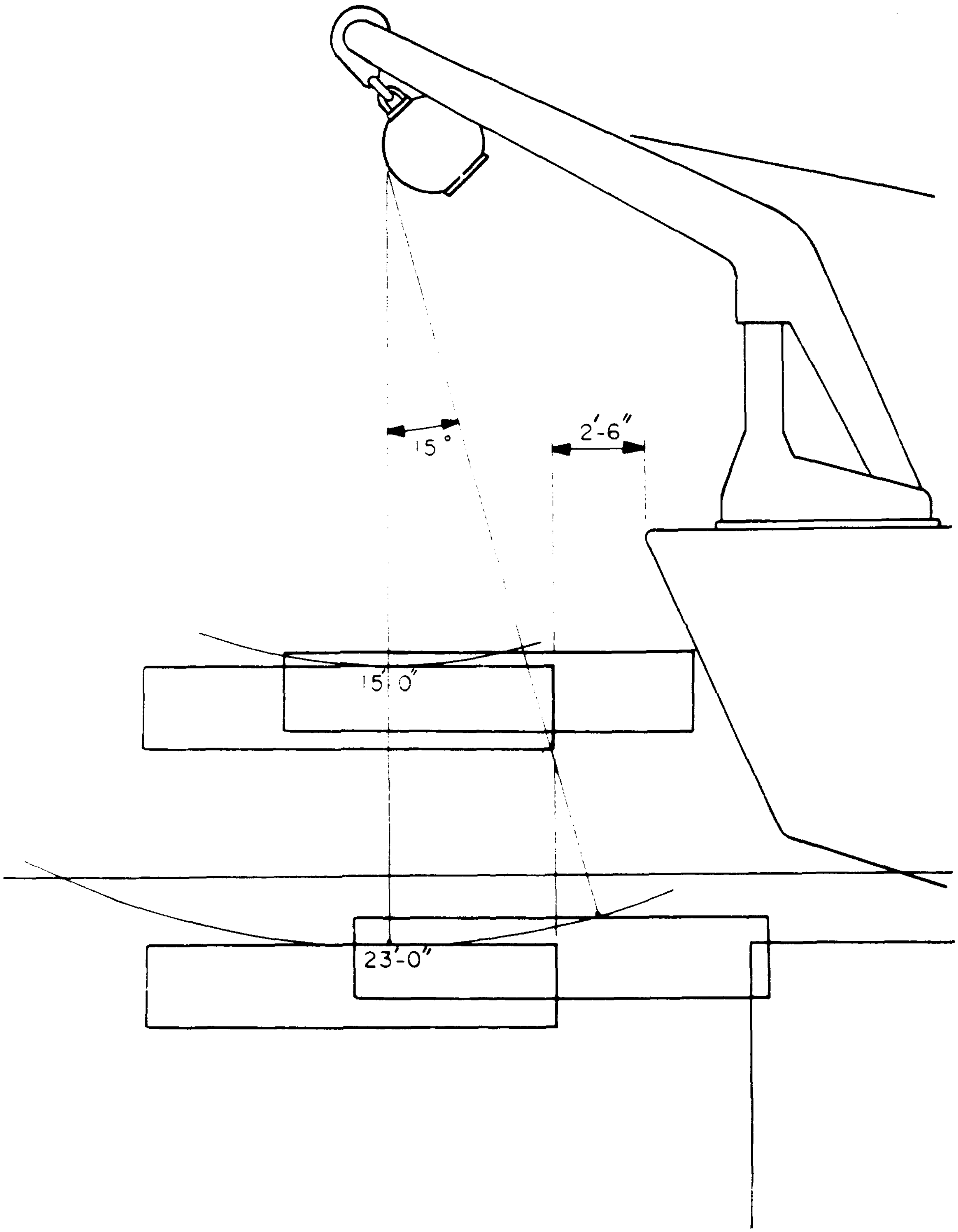


Figure 2. Towbody considerations of original configuration.

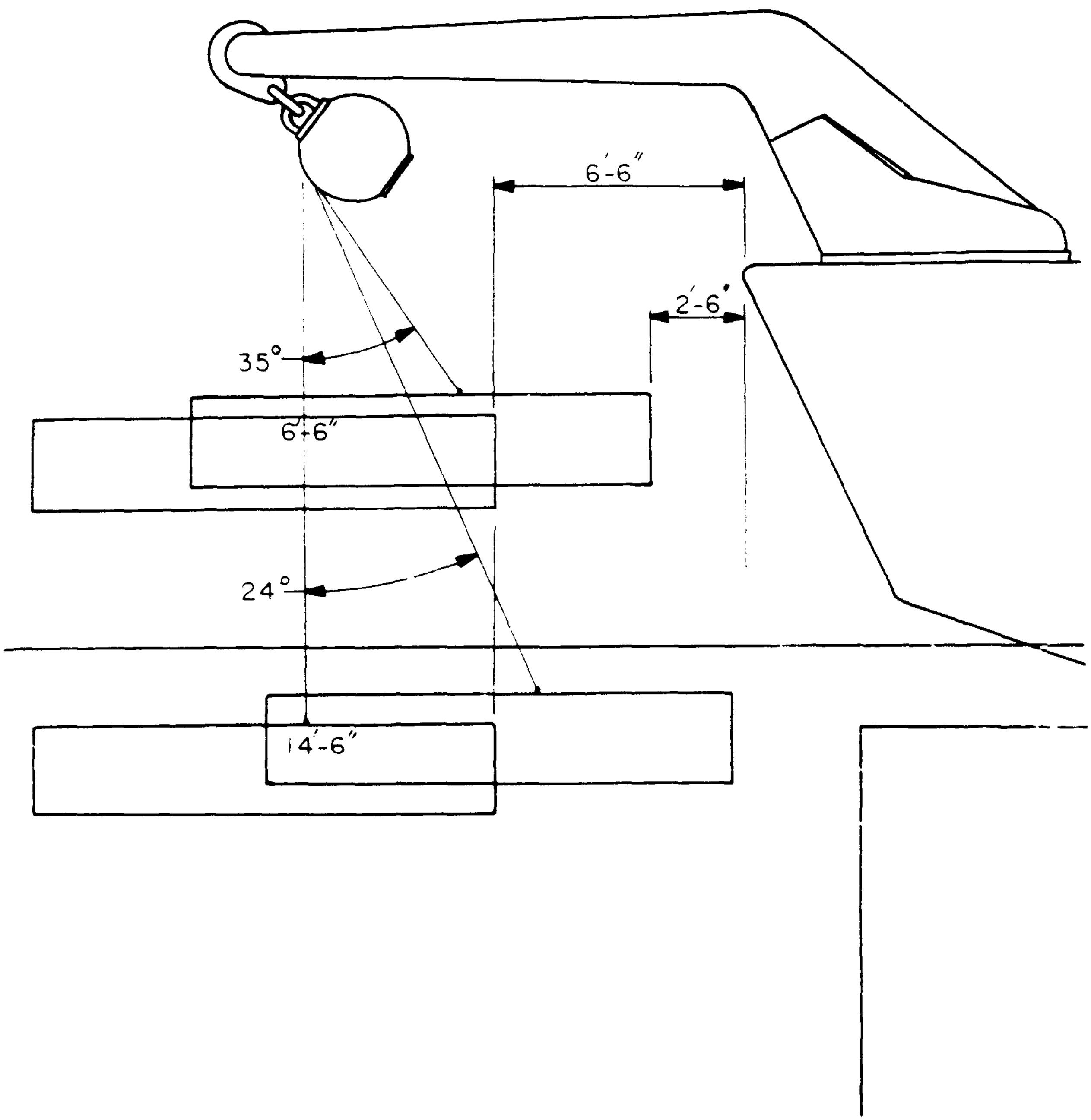


Figure 3. Towbody considerations of modified configuration.

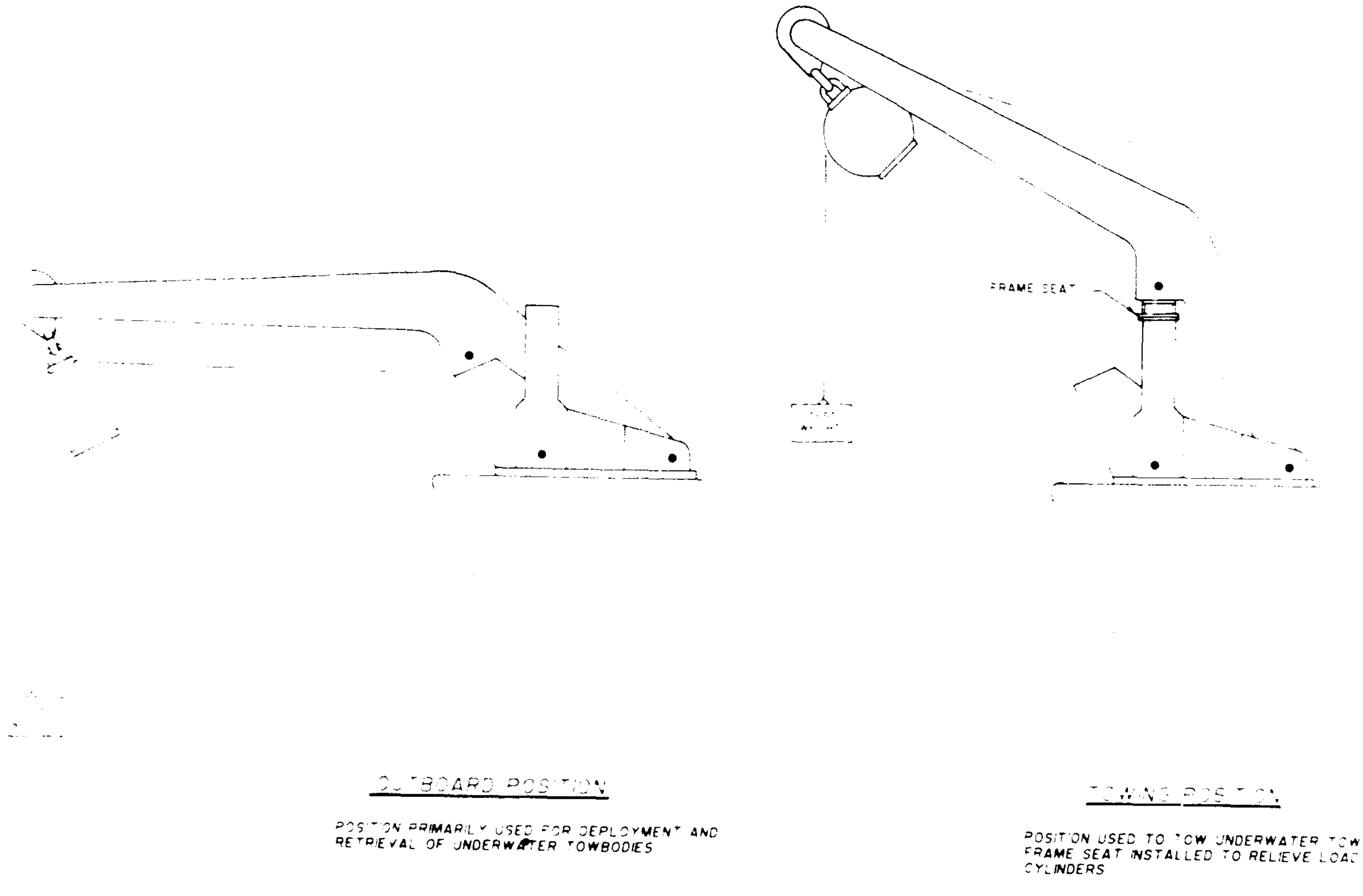


Figure 4. U-Frame positions.

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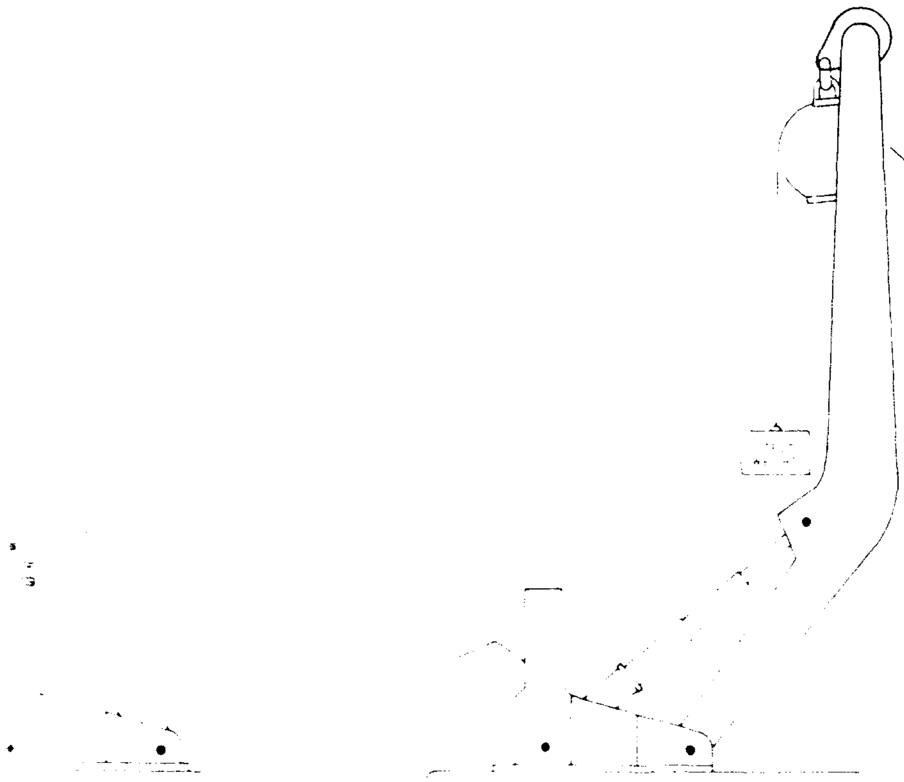
| | | | | |



INBOARD POSITION

...OW UNDERWATER TOWBODIES
...TAINED TO RELIEVE LOADING ON

POSITION USED TO LIFT AND LOWER UNDERWATER TOWBODIES DURING DEPLOYMENT AND RETRIEVAL OPERATIONS

...tors.

ITEM | QTY | NOMENCLATURE

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES
DECIMALS
FRACTIONS
ANGLES

DRAWN
CHECKED
ENGINEER
APPROVED

DO NOT SCALE DRAWING

DEPARTMENT OF THE NAVY
U.S. NAVAL OCEANOGRAPHIC OFFICE
BAY ST. LOUIS, NSTL, MISSISSIPPI

U-FRAME POSITIONS

SIZE D | CODE IDENT 94123 | NAVOCEANO DWG NO 0903026

SCALE

With the new hydraulic cylinders, additional hydraulic fluid volume was required to operate the system. This additional volume was determined to be 25 gallons and required a modification of the hydraulic reservoir to accommodate the fluid volume increase. The expansion of the reservoir was an MSC effort and documentation remains in their retention. The remainder of the hydraulic components did not require modification. To accommodate the structure and cylinder movement, the locking valve manifolds that provide hydraulic fluid to the cylinders and position-holding capability were relocated to a position inside of the support structure.

## V. LOAD RATINGS

The size and capacity of the hydraulic cylinders were determined to provide the same load rating for the U-Frame system as specified by the manufacturer. This load rating is based upon using the fairlead of the Deep Sea Coring System. The system is derated to 6000 pounds of swing load when a direct fairlead from a deck-mounted winch is used.

A detailed system test plan was generated by the Mechanical Systems Branch to thoroughly load test the modified configuration. This test plan is submitted as appendix D.

## VI. CONCLUSIONS

The modification of the Stern U-Frame onboard the USNS SILAS BENT was completed in May 1989. Figures 5 and 6 demonstrate the inboard and outboard positions of the modified configuration. The Stern U-Frame onboard the USNS KANE was modified in October 1989.

The modifications have provided an increase in the outreach of the U-Frame structure, thereby improving its handling capability and reducing the collision potential of large tow bodies. Also, an overall improvement in system operation and personnel safety has been realized.

## VII. RECOMMENDATIONS

Major efforts such as this one lends itself to many interesting engineering challenges and lessons learned. The following recommendations are provided as project management aids in any future engineering efforts of similar scope.

First and foremost, a communication network must be established and maintained to ensure timely and well planned implementation of the work effort. This becomes particularly clear when several regulatory agencies are involved.

Although instrumentation improvements were not targeted as a problem area, improvement of the available hydraulic instrumentation would substantially assist in troubleshooting the system.

Limitations of the U-Frame system must be transitioned to the ship's deck crews periodically due to their high turnover rate.

Maintenance and retesting of the system must be regularly performed to ensure good working order of the equipment. Past performance in these areas indicate a need for serious improvement.

Figure 5. Final Installation, Inboard Position.

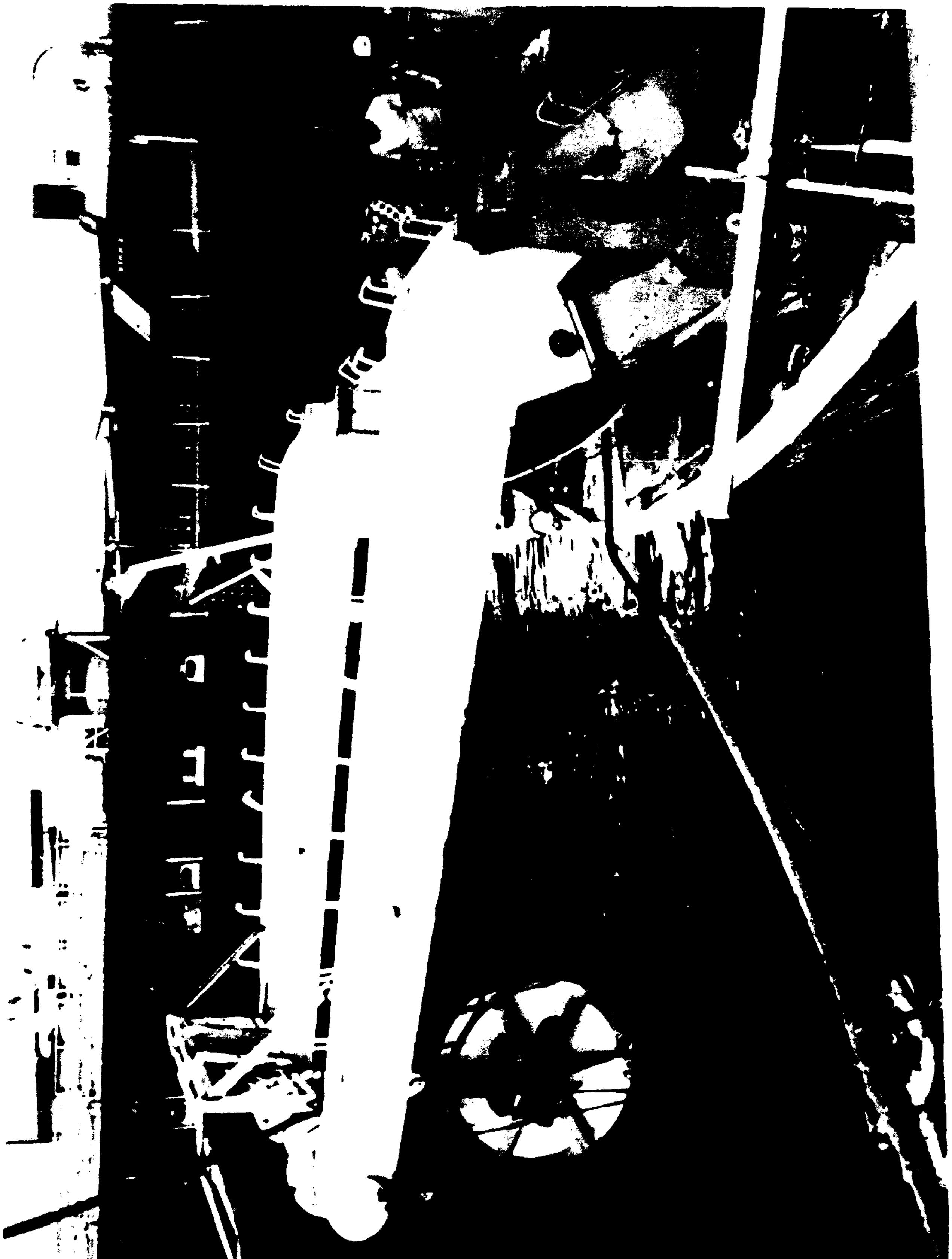
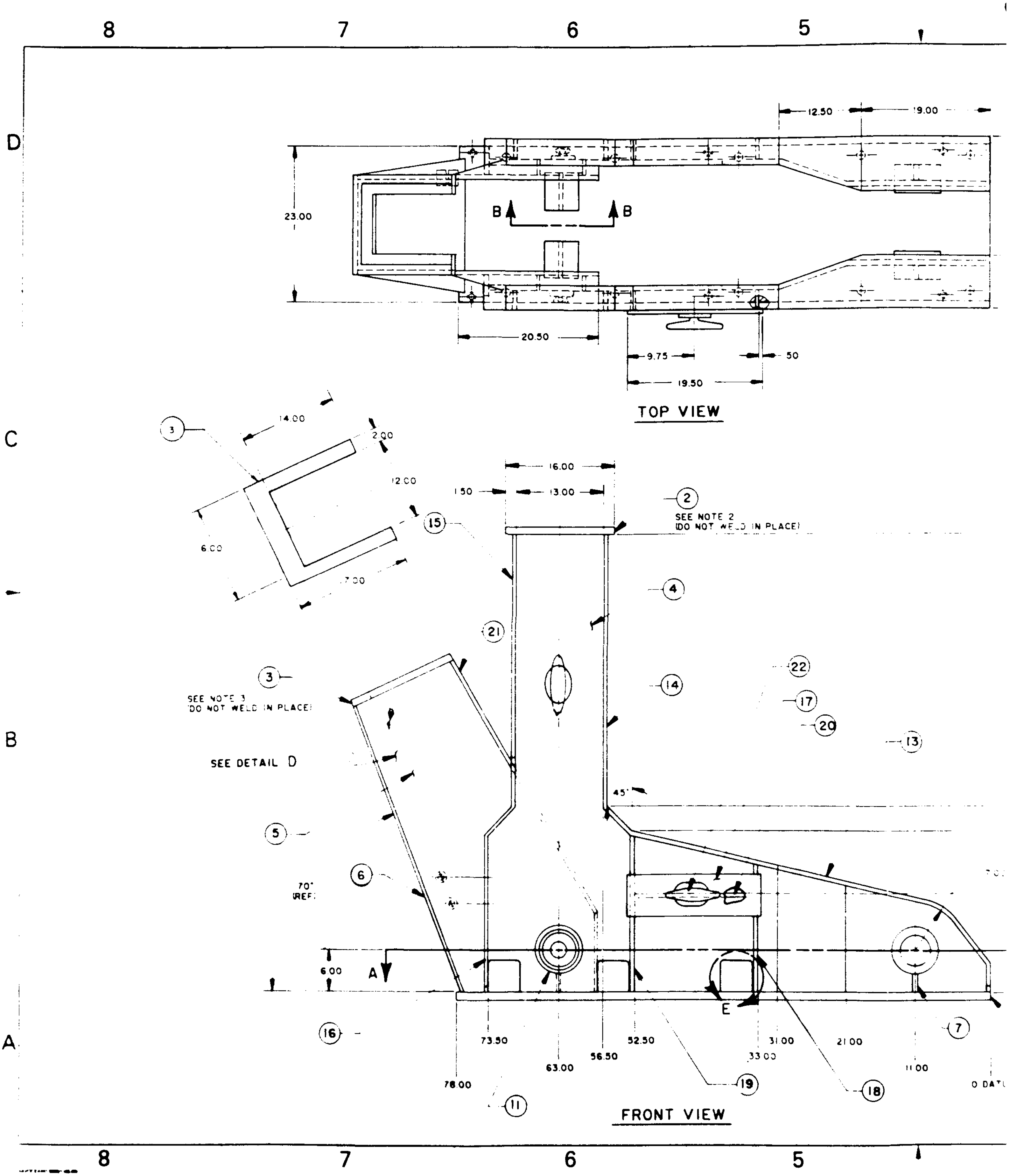


Figure 6. Final Installation, Outboard Position.

# Appendix A
# U-FRAME SUPPORT DRAWINGS



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17.00
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1.50
13.00
2
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(DO NOT WELD IN PLACE)
15
4
21
3
SEE NOTE 3
(DO NOT WELD IN PLACE)
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22
17
20
13
SEE DETAIL D
45°
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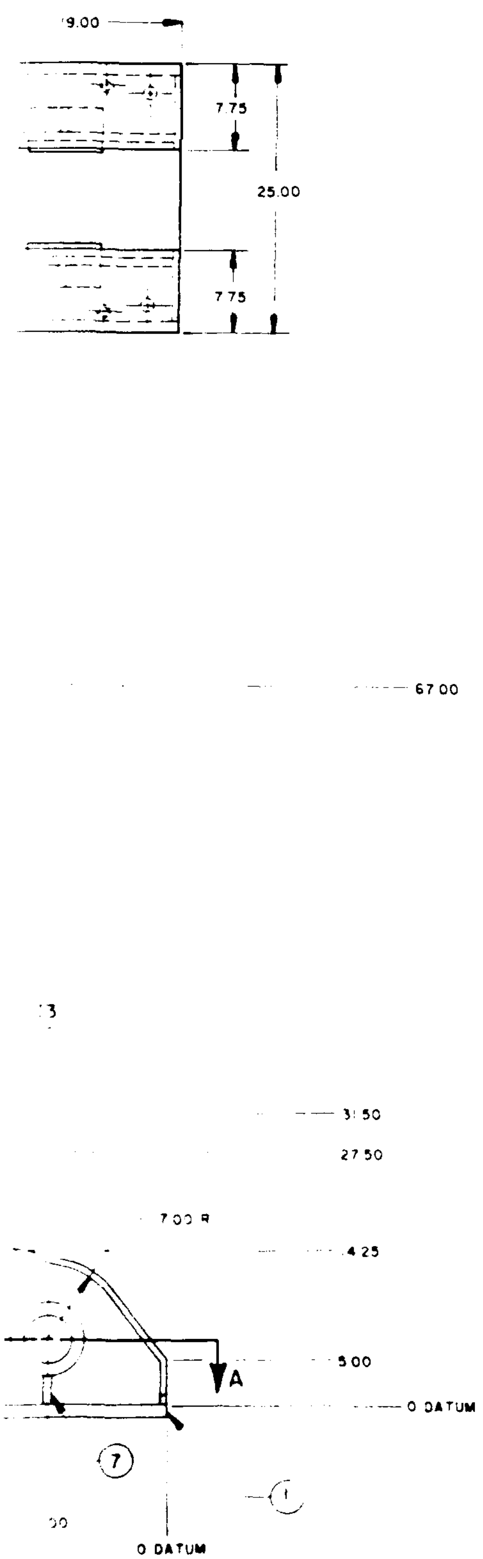
FRONT VIEW




| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | REV | DESCRIPTION | DATE | APPROVED |
| | A | CHANGED DIMENSIONS | [illegible] | [illegible] |

## NOTES:

1. U-FRAME SUPPORT LEG IS A WELDMENT. ALL WELDS TO BE .37 CONTINUOUS FILLET AND BEVEL TYPE UNLESS OTHERWISE SPECIFIED (SEE SECTION C-C).
2. TOWING BEARING PLATES (2) SHALL BE SUPPLIED SEPARATE.
3. OUTBOARD BEARING PLATE (1) SHALL BE SUPPLIED SEPARATE.
4. REMOVE ALL BURRS AND SHARP EDGES .06 R TYPICAL.
5. UNLESS SPECIFIED ALL SURFACES 250/
6. REMOVE ALL WELD SLAG AND SPATTER.
7. ALL WELDS SHALL BE FREE OF VOIDS, CRACKS, AND POROSITY.
8. FINAL FINISH:
   a) DRY ABRASIVE BLASTING TO NEAR WHITE CONDITION, COMMERCIAL GRADE
   b) 2 PRIMER COATS, DIMETCOAT 9 OR EQUAL, 2 MILS DRY FILM THICKNESS EACH COAT.
   c) TOPCOAT, HIGH-EPOXY COATING, 4 MILS DRY FILM THICKNESS, AMERCOAT 383 HS OR EQUAL.
9. FINAL FINISH SHALL NOT BE APPLIED TO INSIDE SURFACES (INTERNAL BORE) OF ITEMS 9, 10, AND 12.
10. FINAL LINE BORING OF ID OF ITEMS 9 AND 10 SHOULD BE PERFORMED AFTER ITEMS HAVE BEEN POSITIONED AND WELDED IN PLACE.

| ITEM | QTY | DESCRIPTION | MATERIAL |
|---|---|---|---|
| 22 | [illegible] | CLEAT, 12 INCH, STEEL | |
| 21 | 2 | STIFFENER, PLATE, .50 THICK | |
| 20 | 1 | STIFFENER, PLATE, .50 THICK | |
| 19 | 2 | STIFFENER, PLATE, .50 THICK | |
| 18 | 2 | STIFFENER, PLATE, .50 THK | |
| 17 | 1 | CHOCK PLATE, FLAT BAR, .50 × 6.00 | |
| 16 | 2 | FLANGE, PLATE, .50 THK | |
| 15 | 2 | FLANGE, FLAT BAR, .50 × 3.50 | |
| 14 | 2 | FLANGE, FLAT BAR, .50 × 3.50 | |
| 13 | 2 | FLANGE, PLATE, .50 THK | ASTM A36 |
| 12 | 2 | COUPLING, ROUND BAR, 1.50 DIA | M-1020 |
| 11 | 2 | TUBING, 7.00 O.D. × .50 WALL | M-A519 |
| 10 | 2 | BEARING, ROUND BAR, 5.00 DIA | M-1020 |
| 9 | 2 | BEARING, ROUND BAR, 7.00 DIA | M-1020 |
| 8 | 2 | BEARING STIFFENER, FLAT BAR, .50 × 3.50 | |
| 7 | 2 | BEARING STIFFENER, FLAT BAR, .50 × 2.50 | |
| 6 | 1 | FACE PLATE, .50 THK | |
| 5 | 2 | SIDE PLATE, .50 THK | |
| 4 | 2 | SIDE PLATE, .75 THK | |
| 3 | 1 | OUTBOARD BEARING PLATE, 1.25 THK | |
| 2 | 2 | TOWING BEARING PLATE, 1.25 THK | |
| 1 | 1 | BASE PLATE, 1.25 THK | ASTM A36 |

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES: DECIMALS .XX ± .03, .XXX ± .010; FRACTIONS ±; ANGLES ± 1°-0'

DRAWN: D. Vaughan 2/ /87
CHECKED: [illegible] -8-85
ENGINEER: [illegible]
APPROVED:

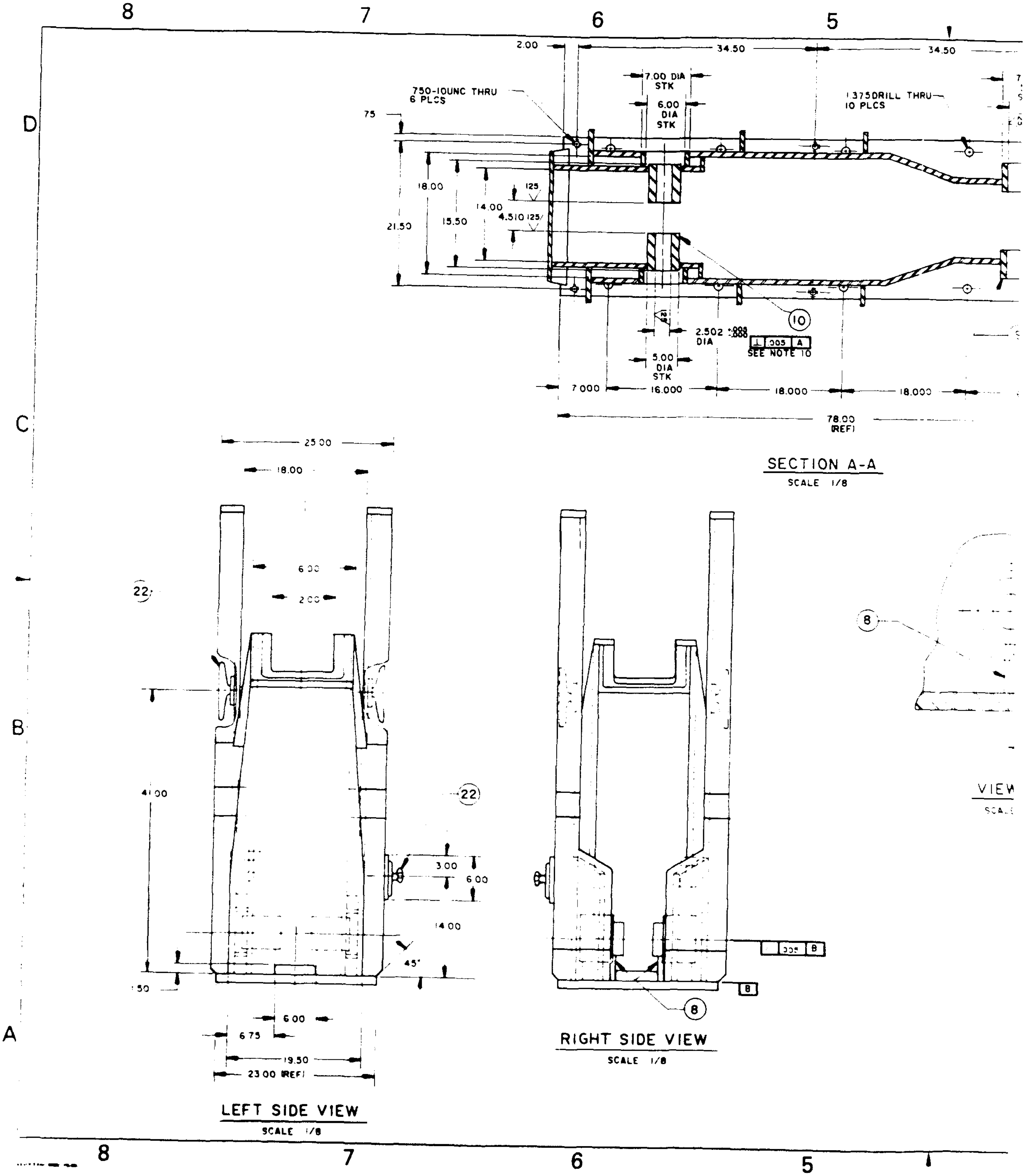
DO NOT SCALE DRAWING

DEPARTMENT OF THE NAVY
U.S. NAVAL OCEANOGRAPHIC OFFICE
BAY ST. LOUIS, NSTL, MISSISSIPPI 39522-5001

# U-FRAME SUPPORT LEGS

SIZE: D | CODE IDENT: 94123 | NAVOCEANO DWG. NO.: 0903023 | REV: A

SCALE: 1/8



2.00
34.50
34.50
7.00 DIA STK
6.00 DIA STK
.750-10UNC THRU 6 PLCS
1.375DRILL THRU 10 PLCS
75
18.00
14.00
21.50
15.50
4.510
125
2.502 DIA
.005 A
SEE NOTE 10
5.00 DIA STK
7.000
16.000
18.000
18.000
78.00 (REF)
10
SECTION A-A
SCALE 1/8
25.00
18.00
6.00
2.00
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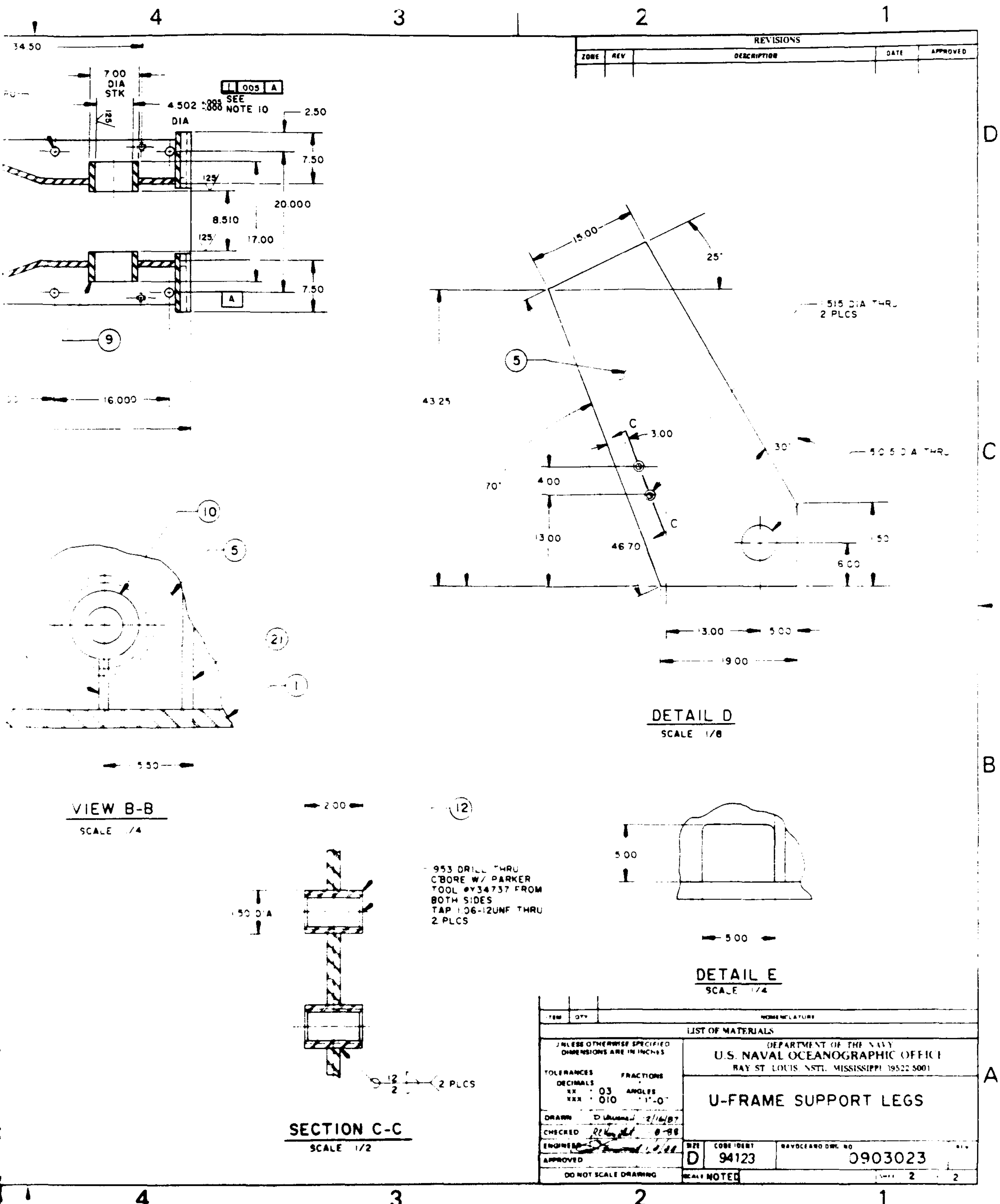
41.00
3.00
6.00
14.00
45°
1.50
6.00
6.75
19.50
23.00 (REF)
LEFT SIDE VIEW
SCALE 1/8
8
.005 B
B
RIGHT SIDE VIEW
SCALE 1/8
VIEW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DESCRIPTION
DATE
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SEE NOTE 10
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C
3.00
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.505 DIA THRU
70°
4.00
13.00
46.70
C
6.00
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5.00
19.00
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SCALE 1/8
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21
1
5.50
VIEW B-B
SCALE 1/4
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12
.953 DRILL THRU C'BORE W/ PARKER TOOL #Y34737 FROM BOTH SIDES TAP 1.06-12UNF THRU 2 PLCS
1.50 DIA
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DETAIL E
SCALE 1/4
2 PLCS
SECTION C-C
SCALE 1/2
ITEM
QTY
NOMENCLATURE
LIST OF MATERIALS
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS
.XX ± .03
.XXX ± .010
FRACTIONS
ANGLES
DEPARTMENT OF THE NAVY
U.S. NAVAL OCEANOGRAPHIC OFFICE
BAY ST. LOUIS, NSTL, MISSISSIPPI 39522-5001
U-FRAME SUPPORT LEGS
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ENGINEER
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94123
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0903023
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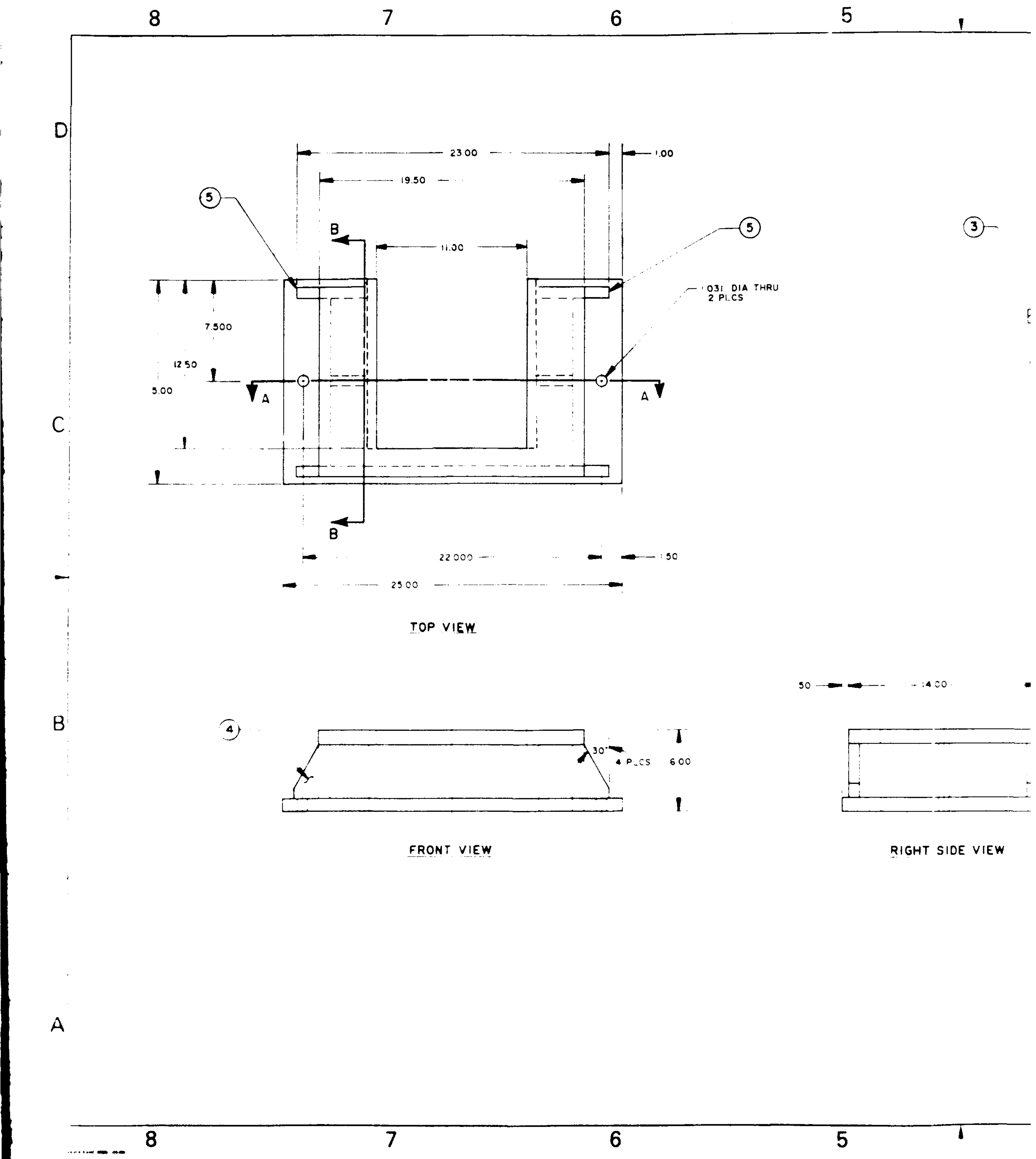
# Appendix B
# U-FRAME SUPPORT SEAT DRAWINGS



23.00
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.031 DIA THRU
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12.50
5.00
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B
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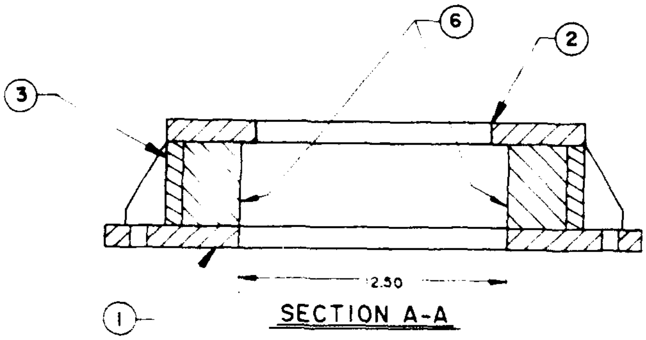
22.000
.50
25.00
TOP VIEW
.50
14.00
30°
4 PLCS
6.00
FRONT VIEW
RIGHT SIDE VIEW

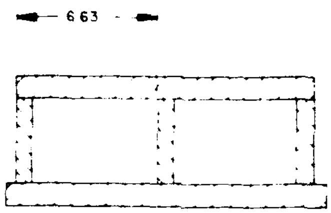
| ZONE | REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | A | REDESIGNED INSIDE OF SEAT | | |

## NOTES

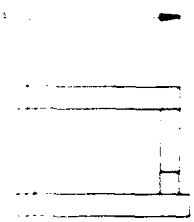
1. FRAME SEAT IS A WELDMENT. ALL WELDS TO BE .37 CONTINUOUS FILLET AND BEVEL AS REQUIRED.
2. REMOVE ALL BURRS AND SHARP EDGES .06 R TYPICAL.
3. UNLESS SPECIFIED ALL SURFACES 250
4. REMOVE ALL WELD SLAG AND SPATTER.
5. ALL WELDS SHALL BE FREE OF VOIDS, CRACKS, AND POROSITY.
6. FINAL FINISH
   - a) DRY ABRASIVE BLASTING TO NEAR WHITE CONDITION COMMERCIAL GRADE
   - b) 2 PRIMER COATS, DIMETCOAT 9 OR EQUAL, 2 MILS DRY FILM THICKNESS EACH COAT.
   - c) TOPCOAT, HIGH-EPOXY COATING 4 MILS DRY FILM THICKNESS, AMERCOAT 383 HS OR EQUAL.




SECTION A-A




SECTION B-B



SIDE VIEW

| ITEM | QTY | NOMENCLATURE |
|---|---|---|
| 6 | 2 | STIFFENER PLATE .75 THK A-36 STEEL |
| 5 | 2 | REAR PLATE, .75 THK, A-36 STEEL |
| 4 | 1 | FRONT PLATE .75 THK, A-36 STEEL |
| 3 | 2 | SIDE PLATE, .75 THK, A-36 STEEL |
| 2 | 1 | TOP PLATE, 1.00 THK, A-36 STEEL |
| 1 | 1 | BASE PLATE, 1.00 THK A-36 STEEL |

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES: DECIMALS .XX ± .03, .XXX ± .010; FRACTIONS ±; ANGLES ±1°-0

DRAWN Vaughan 12-29-87
CHECKED 8 88
ENGINEER
APPROVED

DO NOT SCALE DRAWING

DEPARTMENT OF THE NAVY
U.S. NAVAL OCEANOGRAPHIC OFFICE
BAY ST. LOUIS, NSTL, MISSISSIPPI 39522-5001

# FRAME SEAT

SIZE D | CODE IDENT 94123 | NAVOCEANO DWG NO 0903025 | A

SCALE 1/4

# Appendix C

## CYLINDER SALIENT CHARACTERISTICS
## CYLINDER DRAWING
## STAGE COVER DRAWING

## SALIENT CHARACTERISTICS FOR HYDRAULIC CYLINDER

1. **General description**

1.1 The hydraulic cylinder shall be a dual-acting, three-stage telescoping cylinder to be used in lifting and lowering of a Stern U-Frame.

2. **Operating characteristics**

2.1 Electrical characteristics. None.

2.2 Mechanical characteristics

2.2.1 Nominal cylinder capacities at operation pressure shall be as follows:

| | | |
|---|---|---|
| Extension - | 1st stage | 175,000 lbs. |
| | 2nd stage | 110,000 lbs. |
| | 3rd stage | 65,000 lbs. |
| Retraction - | 1st stage | 40,000 lbs. |
| | 2nd stage | 25,000 lbs. |
| | 3rd stage | 25,000 lbs. |

2.2.2 Cylinder shall have an operating pressure of 2000 psi and an operating flow rate of 27 gallons per minute. Cylinder shall be designed for a bursting pressure of not less than 4 times the maximum allowable system pressure.

2.2.3 Cylinder internal seals shall be U or V type for dual-direction operation. Seals shall provide maximum sealing and minimal leakage.

2.2.4 Cylinder shall have a total stroke of 70 inches.

3. **Physical characteristics**

3.1 Materials

3.1.1 Cylinder body shall be fabricated of high-strength, medium-grade steel (1026 cold drawn DOM tubing, 75,000-psi yield strength) and finished with a marine grade epoxy paint system to withstand the environmental conditions in section 5.2 of this salient characteristic.

3.1.2 Each moving state of the cylinder shall be fabricated of chrome-plated, high-strength (1026 cold drawn DOM tubing, 75,000-

psi yield strength), medium-grade steel or better, to prevent corrosion. Chrome plating shall have a minimum thickness of .001 inches.

3.2 Dimensional size

3.2.1 Cylinder ends, hydraulic ports, and basic body dimensions shall conform to NAVOCEANO Drawing No. 0903024 Rev. B. Dimensions on actual stage diameters are approximate.

4. **Interfaces.** None.

5. **Environmental conditions**

5.1 Storage conditions

5.1.1 Cylinders shall be capable of full operation following prolonged storage at 90% relative humidity and 100 degrees F.

5.2 Operating conditions

5.2.1 Cylinder shall be designed and constructed for use while mounted on the weather deck of an oceanographic research ship.

5.2.2 Cylinder shall be constructed to withstand continuous exposure to salt spray and occasional salt water drenchings.

5.2.3 Cylinder shall be capable of operation under the following conditions:

| | |
|---|---|
| Ambient Temp: | 0 degrees F to 120 degrees F |
| Inclination: | 30 degrees from horizon in all directions |
| Sea State: | Up to Sea State 6 |

6. **Other provisions**

6.1 Transportation containers

6.1.1 Cylinder shall be provided in a transportation container suitable for commercial transit.

7. **Documentation**

7.1 Operation and maintenance manual

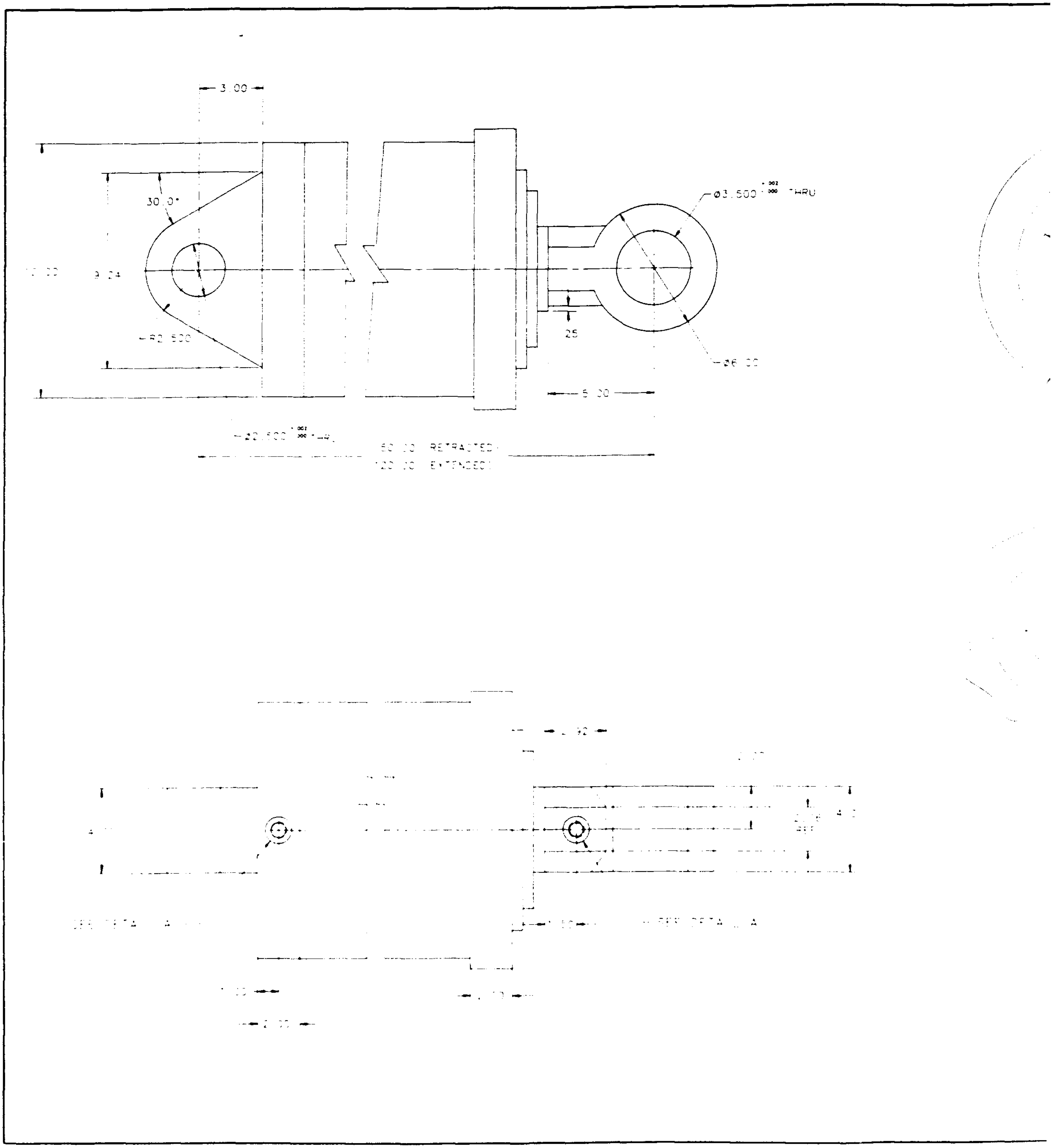
7.1.1 An operation and maintenance manual shall be provided with each cylinder. Manual shall be in the contractor's format.

7.2 Drawings

7.2.1 Mechanical assembly drawings shall be provided with each cylinder. Drawings shall be D-sized and in the contractor's format.

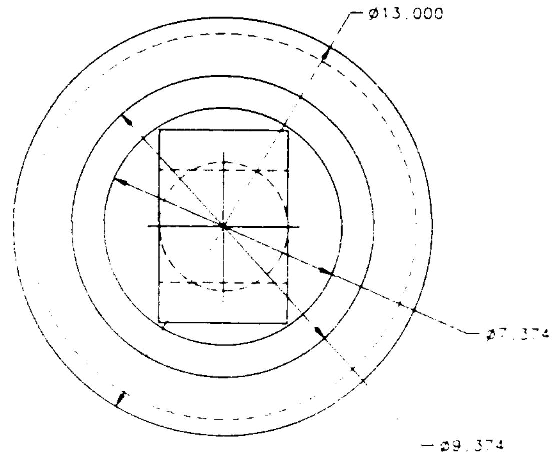
## 8. Installation

8.1 Contractor assistance. None.



3.00
30.0°
9.24
R2.500
Ø3.500 THRU
.25
5.00
RETRACTED

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | REV. | DESCRIPTION | DATE | APPROVED |
| | A | REDESIGN OF CYLINDER | [illegible] | [illegible] |
| | B | CHANGED DIMENSIONS | [illegible] | [illegible] |

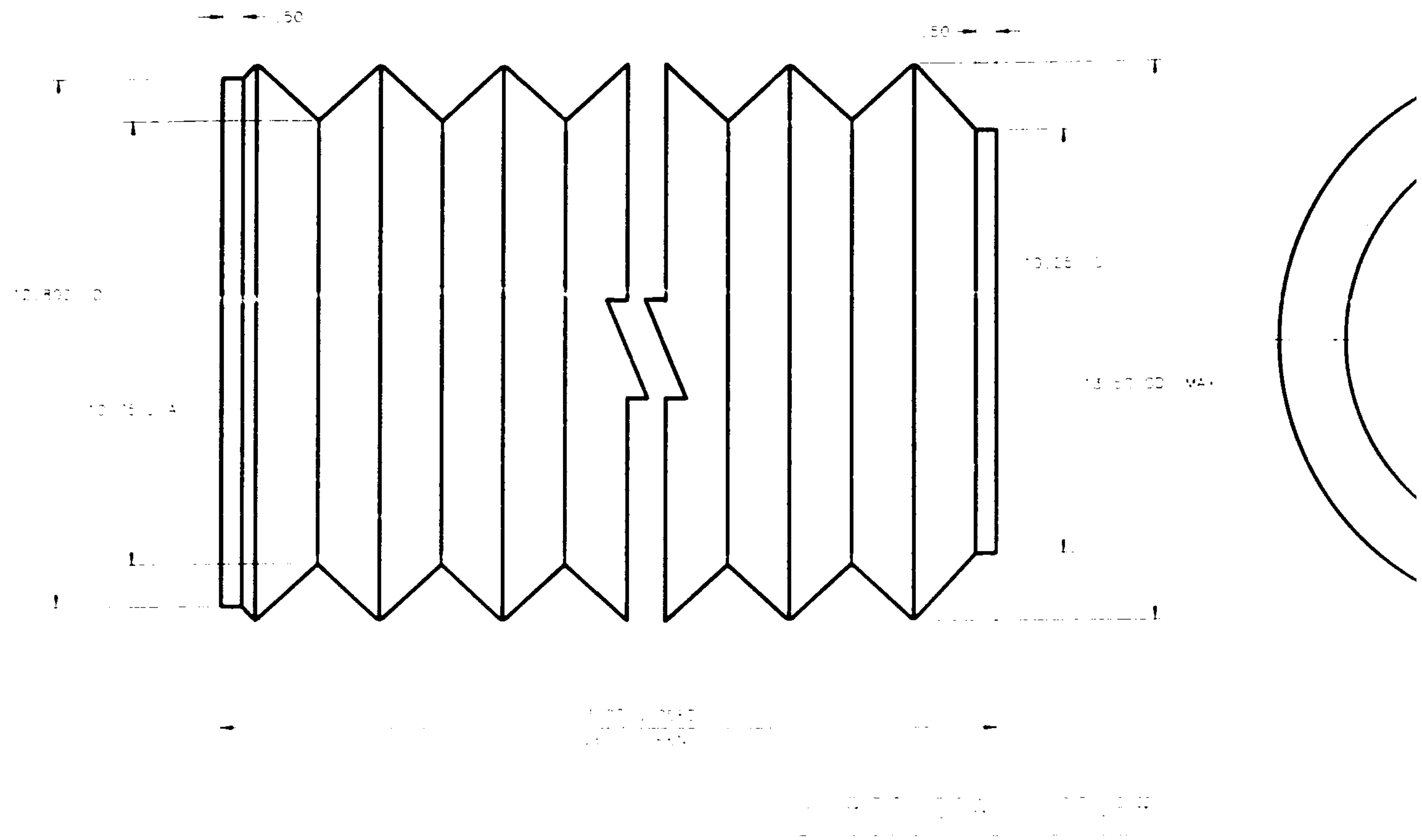


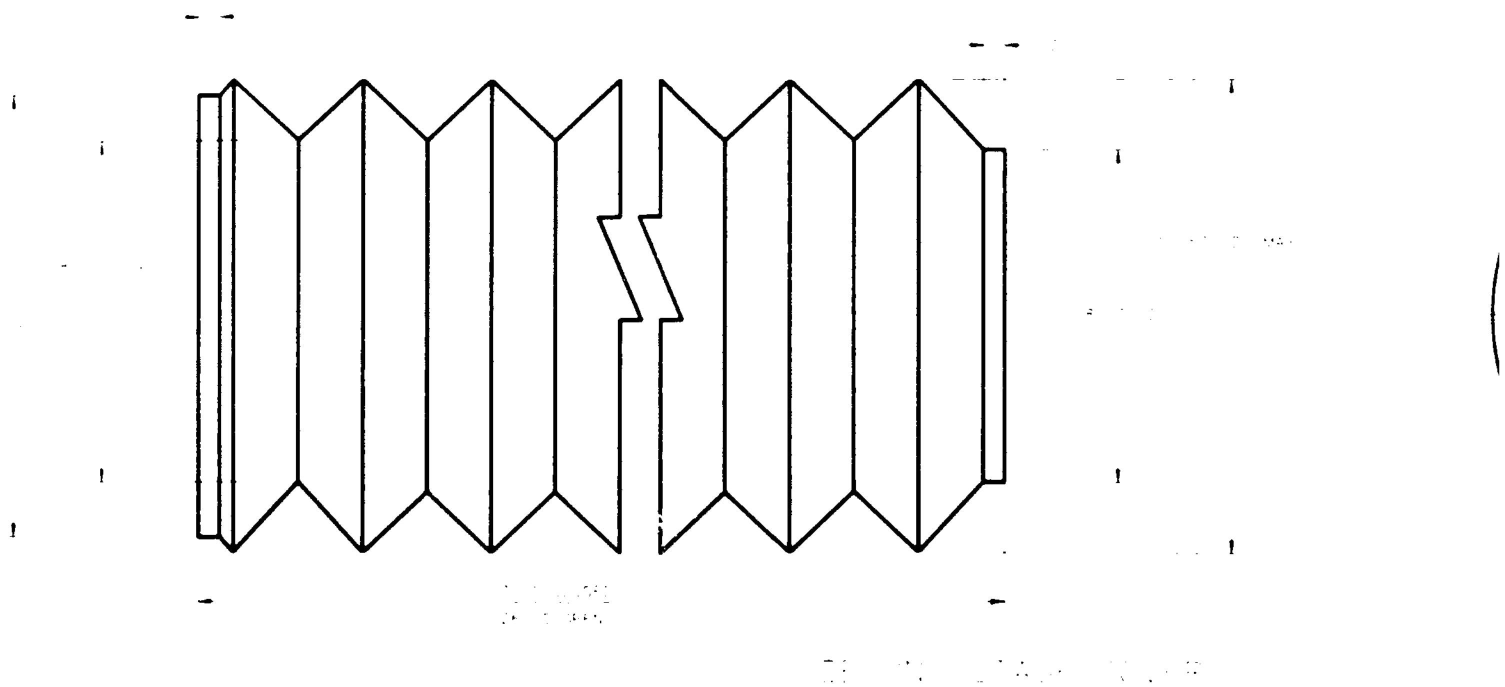

NOTES:

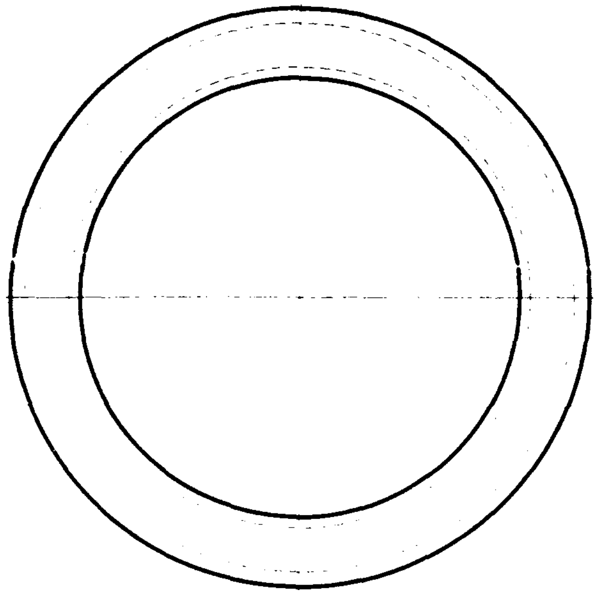
1. CYLINDER OPERATING PRESSURE TO BE 2000 PSI
2. CYLINDER STROKE TO BE 70.00 INCHES.
3. CLINDER STAGES ARE APPROXIMATE. STAGES SHOWN SLIGHTLY EXTENDED TO CLARIFY CONFIGURATION.
4. PORTS TO BE LOCATED ON SAME SIDE OF CYLINDER

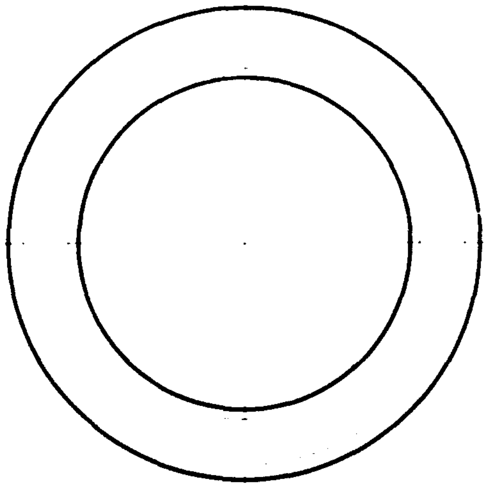
DETAIL A

| | |
|---|---|
| ITEM / QTY | NOMENCLATURE |
| LIST OF MATERIALS | |
| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES: DECIMALS .XX ± .03, .XXX ± .010; ANGLES ± 1-0°; FRACTIONS ±; SURFACE FINISH 125 | DEPARTMENT OF THE NAVY — U.S. NAVAL OCEANOGRAPHIC OFFICE — STENNIS SPACE CENTER, MS [illegible] |
| DRAWN / CHECKED / ENGINEER / APPROVED | TELESCOPING HYDRAULIC CYLINDER |
| DO NOT SCALE DRAWING | SIZE D — CODE IDENT 94123 — NAVOCEANO DWG NO. [illegible] — REV. B — SCALE 3:8 — SHEET [illegible] |


.50
.50







REVISIONS

| ZONE | REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | | | | |

NOTES:

1. MATERIAL ...
2. 2 COVERS REQ'D ...
   - EACH FIRST ...
   - EACH SECOND ...

| ITEM | QTY | NOMENCLATURE |
|---|---|---|

**LIST OF MATERIALS**

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: DECIMALS, ANGLES, FRACTIONS
SURFACE FINISH

| | | |
|---|---|---|
| DRAWN | ... LADNER | 8-7-89 |
| CHECKED | | 8-89 |
| ENGINEER | | 8-89 |
| APPROVED | | 8-89 |

DO NOT SCALE DRAWING

**U.S. NAVAL OCEANOGRAPHIC OFFICE**

SIZE: D | CODE IDENT: 94123

SCALE

# Appendix D

# SYSTEM TEST PLAN FOR STERN U-FRAME

## 1.0 INTRODUCTION

This test plan describes the test criteria to be used in the installation, operation, and certification of the Stern U-Frame structures used on the USNS SILAS BENT and KANE. An effort has been undertaken to modify the U-Frames of these ships in order to extend the outboard reach of the frames, thereby decreasing the risk of damaging highly sophisticated underwater equipment during launch and recovery operations. In the past, numerous collisions have occurred between underwater towbodies such as TARSUS, LFTAPS, and TAPS and the stern of the above-mentioned vessels.

The engineering approach of the modification is to replace the driving, single-stage, hydraulic cylinders with three-stage hydraulic cylinders to increase the swing range of the frame. Redesign of the support structures for the frames followed, and expansion of the hydraulic fluid reservoir of the frame's power unit was required. All other system components remained unchanged.

## 2.0 TEST OBJECTIVES

The technical objectives of this test plan are three-fold. The primary objective is to certify the operational condition of the frame. This objective is satisfied by an overall evaluation of "Fully-Operational" after all testing is completed. Secondary objectives are verifying the load-rating and load-holding capabilities as specified in the manufacturer's operational manual for the system. Accomplishment of the secondary objectives will be direct conformance of the test values with the corresponding values as indicated in the operation manual.

## 3.0 REFERENCES


3.1 Technical Manual For U-Frame, USNS SILAS BENT and KANE, T&L Associates, Inc., 1977.

3.2 Operation and Maintenance Manual, Navy Cylinder, Phelps Industries, Inc., 1989.


## 4.0 TEST DESCRIPTION

This test plan will describe the overall test procedure for obtaining important system operating parameters and evaluating the operational condition of the U-Frame. The testing of the U-Frame will be performed in three phases. A start-up period begins the tests. During this test period the U-Frame will be warmed up and its system pressures will be checked.

Next, the U-Frame will be subjected to varying loading conditions to verify its load rating and loading capabilities. Finally, the U-Frame will be inspected for any damaged parts or fluid leaks. Any system adjustments will be performed and the frame will be exercised to confirm the adjustments. An overall system evaluation will be made.

## 5.0 TEST PREPARATION

The typical towing scenario being used involves the fair-leading of a cable directly from a dedicated winch, located on the ship's fantail, to the center towing eye on the U-frame. This fairlead varies from the design fairlead of the frame; therefore, the load attached to the cable must be adjusted to create the same stress conditions.

In order to safeguard against possible damage to a project-dedicated winch and cable, the Intermediate Coring Winch and cable are to be used. The cable should be fairlead from the winch room up to the fantail. Once around the vertical turning sheave that brings the cable up to the fantail, the cable should be fairlead directly to the overboarding sheave on the U-frame. The end of the cable should be prepared for attachment to a test weight via a shackle. See attachment A for the test set-up diagrams.

Arrangements should be made to have test weights available at pier-side, along with crane service to position the test weights onboard. The crane's lifting line should remain attached, but slightly slackened, to the weights to add a measure of safety in the event of a mechanical difficulty or failure. Test weights of 4000, 5000, and 6000 pounds will be used during testing. A single 4000-pound weight and two 1000-pound attachable weights will fulfill the test weight requirements.

If uneven frame movement or frame creep has been experienced during normal operation, a hydraulic contractor should be contacted to check out the system. In particular, the counter-balance valves located in the holding valve manifolds should be adjusted or replaced if necessary. Also, the piston seals of the hydraulic cylinders should be inspected and replaced if necessary. (See references 3.1 and 3.2 for component information.)

## 6.0 TEST MANAGEMENT AND RESPONSIBILITY

Several key personnel are required to perform and monitor the testing procedures. These personnel are the Port Engineer, Senior NAVOCEANO Representative (SNR), Chief Officer, and support deck crew. The Port Engineer, SNR, and Chief Officer are responsible for the monitoring of the testing and the approval of the resulting evaluation. The Port Engineer is also responsible for management and documentation of the tests. The deck crew, under the supervision of the Chief Officer, is responsible for the operation of the U-Frame and the Intermediate Coring Winch.

## 7.0 TEST SCHEDULE

A typical U-Frame test can be performed in the course of an 8-hour day. The morning hours are devoted to system check-out and warm-up. All items specified in section 5.0 should be accomplished within the first 3 hours. The afternoon will be used to perform the various load tests and document the results. The final hour of the day should be used to perform any system adjustments and approve test results.

## 8.0 TEST PROCEDURE

### 8.1 START-UP (NO LOAD)

Start-up procedures begin with a brief system inspection to determine the existing condition of the equipment. Visually inspect the U-Frame assembly and power unit for any initial problem areas. Any major problems should be corrected before any further testing occurs. The system should be turned on and cycled from inboard stop to outboard stop at least 5 times to allow the hydraulic system to warm up. During the cycling period, system pressure as indicated by a pressure gauge located on the power unit should be monitored and compared to the specified value (2000 psi) per reference 3.1. Relief valve pressure setting should be 2200 psi per reference 3.1.

If system and relief valve pressure settings are not the prescribed values, adjust them in accordance with reference 3.1. Check for any hydraulic leaks and correct as necessary.

### 8.2 LOAD TESTING

This portion of testing will require considerable coordination between frame, winch, and shore crane operators to perform the desired tests safely. A meeting between the operators to discuss the test procedures and directions is important to address any questions and concerns before testing begins. The Chief Officer should assign a person such as the ship's Boatswain to direct all of the operators during the tests.

With the U-Frame in the inboard position, attach the first test weight (4000 pounds) to the test cable. Lift the test weight and cycle the frame from inboard to outboard stops 2 times, monitoring the behavior of the frame. Frame movement should be smooth and controlled. Note any unusual behavior before continuing.

Increase the test weight to 5000 and 6000 pounds consecutively, repeating the frame cycling procedure for each weight. Note any unusual behavior before continuing.

## 8.3 **FINAL INSPECTION**

After completion of the load testing portion of the test plan, a final visual inspection should be performed. At this time, any system adjustments should be made and hydraulic leaks corrected. If any adjustments are made, additional cycles of the frame should be performed to verify operational condition.

Finally, the Port Engineer should prepare a test report in accordance with attachment B. The Port Engineer should retain the signed original and furnish copies to the SNR and Chief Officer.

## 9.0 **CONTINGENCIES**

Because of the uncertainty of the condition of the controls and operation of the Intermediate Coring Winch system, an alternate approach has been used in the past to rig the U-Frame for load testing. Attaching a test weight of 8000 pounds directly to the center towing eye of the frame will adequately approximate the loading conditions as those resulting from section 5.0. No winch coordination is required to perform the tests using this method, but it is not the preferred method because of the different fairleading arrangement.

Provision for hydraulic contractor availability is an important contingency to cover. The nature of hydraulics is such that minor parts and adjustments may be required to complete a job, and a good hydraulic contractor can solve an unexpected problem very quickly.

## 10.0 **TEST RESULTS**

The results of all tests performed in conjunction with this test plan shall be tabulated and incorporated within a formal test report. The test report shall be reviewed by all responsible personnel as outlined in section 6.0 and copies of the report distributed accordingly.

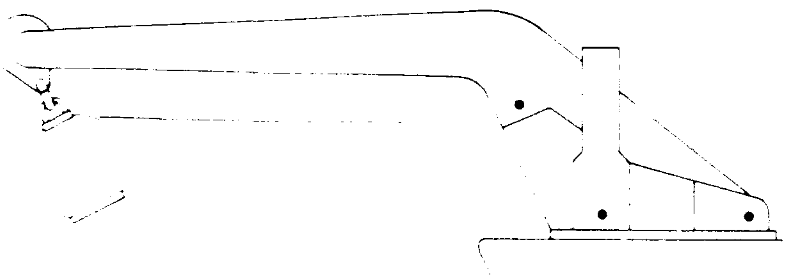
## Attachment A

## U-FRAME POSITIONS
## TEST CABLE FAIRLEAD

8 7 6 5

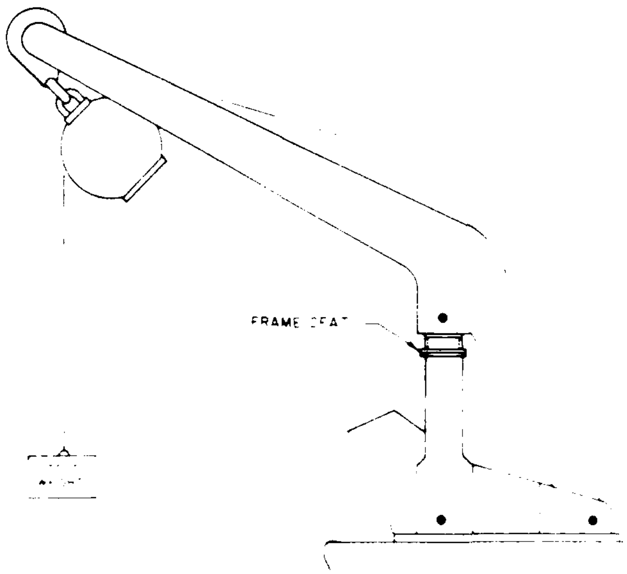
D

C



OUTBOARD POSITION

POSITION PRIMARILY USED FOR DEPLOYMENT AND RETRIEVAL OF UNDERWATER TOWBODIES




TOWING POSITION

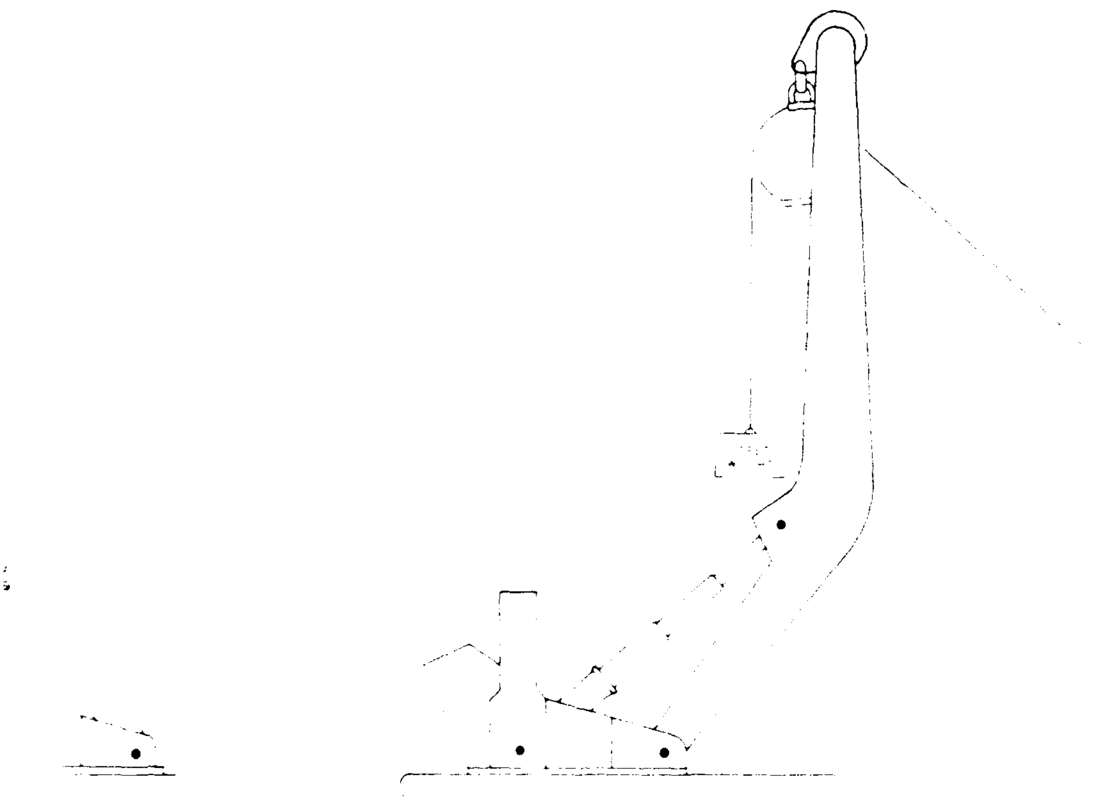
POSITION USED TO TOW UNDERWATER T
FRAME SEAT INSTALLED TO RELIEVE LO
CYLINDERS

B

A

8 7 6 5

| ZONE | REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | | | | |



SITION

W UNDERWATER TOWBODIES
TO TO RELIEVE LOADING ON

NBOARD POSITION

POSITION USED TO LIFT AND LOWER UNDERWATER TOWBODIES DURING DEPLOYMENT AND RETRIEVAL OPERATIONS

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES
DECIMALS
FRACTIONS
ANGLES

DRAWN
CHECKED
ENGINEER
APPROVED

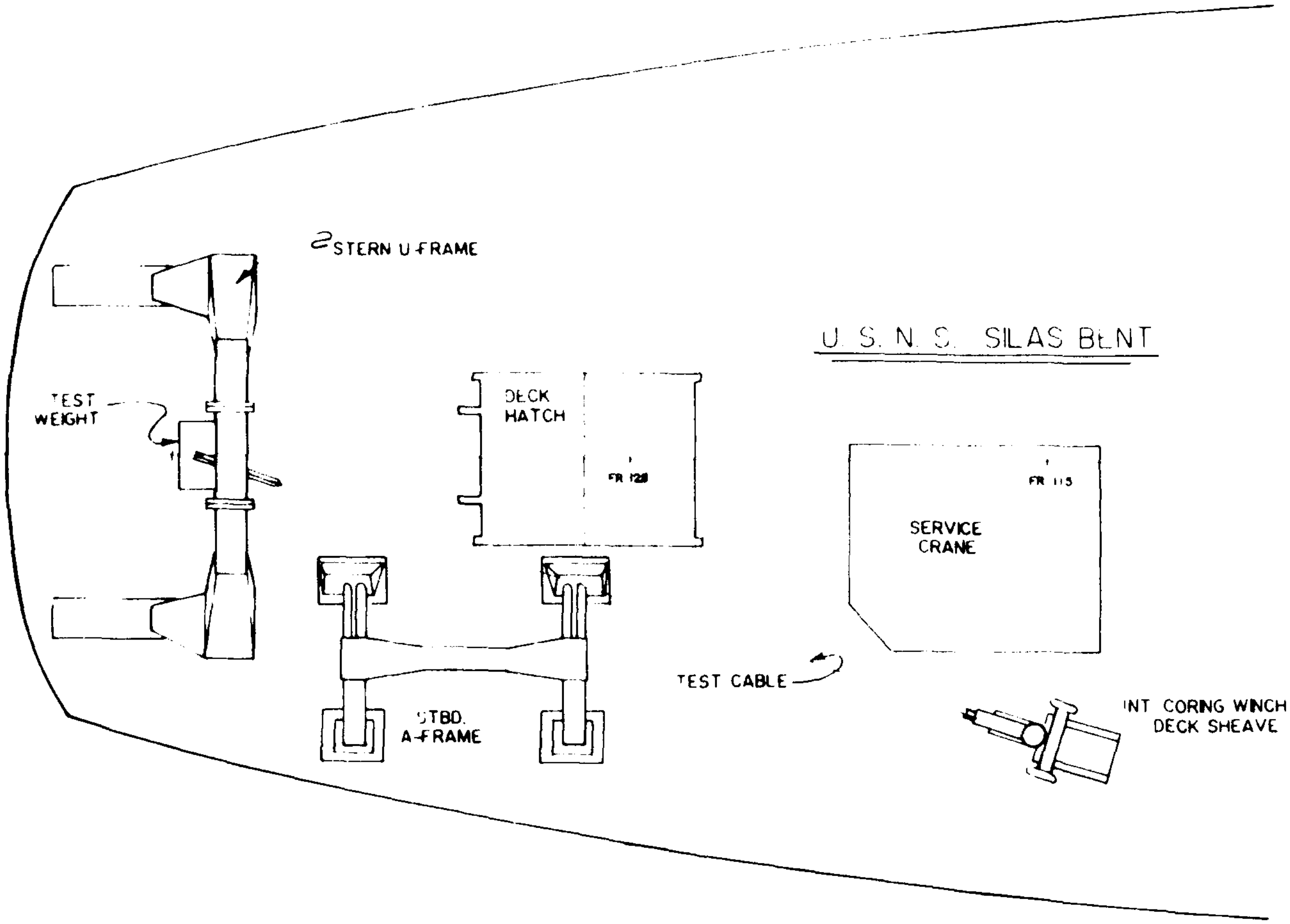
DO NOT SCALE DRAWING

DEPARTMENT OF THE NAVY
U.S. NAVAL OCEANOGRAPHIC OFFICE
BAY ST. LOUIS, NSTL, MISSISSIPPI

U-FRAME POSITIONS

| SIZE | CODE IDENT | NAVOCEANO DWG NO |
|---|---|---|
| D | 94123 | 0903026 |

SCALE


U. S. N. S. SILAS BENT
STERN U-FRAME
TEST WEIGHT
DECK HATCH
FR 128
SERVICE CRANE
FR 115
STBD. A-FRAME
TEST CABLE
INT CORING WINCH DECK SHEAVE

# Attachment B
# SAMPLE TEST REPORT

| SHIP NAME: | DATE: |
|---|---|
| PORT OF CALL: | |

START-UP CONDITION:
Hydraulic Reservoir Level (gallons):
Operating System Pressure (psi):
Relief Valve Pressure (psi):
Frame Movement (smooth or jumpy):
Condition of Hydraulic Lines and Fittings:

Additional Comments:

LOAD TEST RESULTS:

Test Weights: (a) __________ pounds
(b) __________ pounds
(c) __________ pounds

Operating System Pressure (psi):

Relief Valve Pressure (psi):

Hydraulic Reservoir Level (gallons):

Frame Movement:

Condition of Hydraulic Lines and Fittings:

Additional Comments:

ADJUSTMENTS:

RECOMMENDATIONS:

| OVERALL EVALUATION: (Check one) | FULLY-OPERATIONAL | |
|---|---|---|
| | MARGINAL | |

| SIGNATURES | PORT ENGINEER: |
|---|---|
| SNR: | CHIEF OFFICER: |